VAISALA

USER'S GUIDE

Vaisala Radiosonde RS92-D

RS92-DD
E1650060

Table of Contents

List of Figures

List of Tables

CHAPTER 1
GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

About This Manual

This manual provides information for operating the Vaisala Radiosonde RS92-D.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information: This chapter provides general notes for the manual and the product.

- Chapter 2, Product Overview: This chapter introduces the features and advantages of the radiosonde.

- Chapter 3, Operation: This chapter contains information that is needed to operate this product.

- Chapter 4, Storage and Transportation: This chapter provides information for the transport and storage of the product.

- Chapter 5, Failure Report and Warranty: This chapter presents information about the failure report and radiosonde warranty.

- Appendix A, Safety Instructions for Balloon Operators: This appendix contains details of safe and proper balloon preparation.

Version Information

Table 1   Manual Versions

Manual Code	Description
M210987EN-C	May 2010. Updated instructions for transporting lithium batteries.
M210987EN-B	January 2010. For RS92-DD and RS92-DL.
M210987EN-A	June 2009. For RS92-DD only

Related Manuals

Table 2   Related Manuals

Manual Code	Manual Name
M010117EN	Radiotheodolite RT20A and DigiCORA®
M210329EN	Ground Check Set GC25 User's Guide
M211025EN	Configuring and Operating MW12, RT20 Systems and RS92 Radiosondes

General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE	Note highlights important information on using the product.

Feedback

Vaisala Customer Documentation Team welcomes your comments and suggestions on the quality and usefulness of this publication. If you find errors or have other suggestions for improvement, please indicate the chapter, section, and page number. You can send comments to us by e-mail: manuals@vaisala.com.

Product-Related Safety Precautions

WARNING	Conduct soundings in a safe environment and in accordance with all applicable restrictions and regulations.

WARNING	Do not use the radiosonde in an area with power lines or other obstructions overhead. Make sure that you check the area for such obstructions before using the radiosonde.

WARNING	Do not use the radiosonde without consultation and cooperation with local and other applicable aviation authorities.

CAUTION	Do not modify the unit. Improper modification can damage the product or lead to malfunction.

CAUTION	Do not use the radiosonde for any purpose other than for soundings.

Recycling

	Recycle all applicable material.

	Dispose of batteries and the unit according to statutory regulations. Do not dispose of with regular household refuse.

License Agreement

All rights to any software are held by Vaisala or third parties. The customer is allowed to use the software only to the extent that is provided by the applicable supply contract or Software License Agreement.

CHAPTER 2
PRODUCT OVERVIEW

This chapter introduces the features and advantages of the radiosonde.

Introduction to Vaisala Radiosonde RS92-D

The digital Vaisala Radiosonde RS92-D offers excellent accuracy in humidity, pressure, temperature, and wind measurement.

The radiosonde features digital data transmission, which offers important advantages over analog data transmission. Data availability during a sounding is excellent, and telemetry errors are always detected. The digital transmitter also consumes less power than an analog transmitter, and more channels are available in the meteorological frequency band.

The sounding system used with RS92-D reads the calibration coefficients stored in the radiosonde memory via a cable or telemetry link. The humidity sensors can be reconditioned to remove any chemical contaminants to ensure excellent humidity measurement accuracy.

The RS92-D is compliant with the European ETSI standard for digital radiosondes operating in the 1680 MHz band, EN 302 054. The radiosonde transmitter frequency can be set electronically.
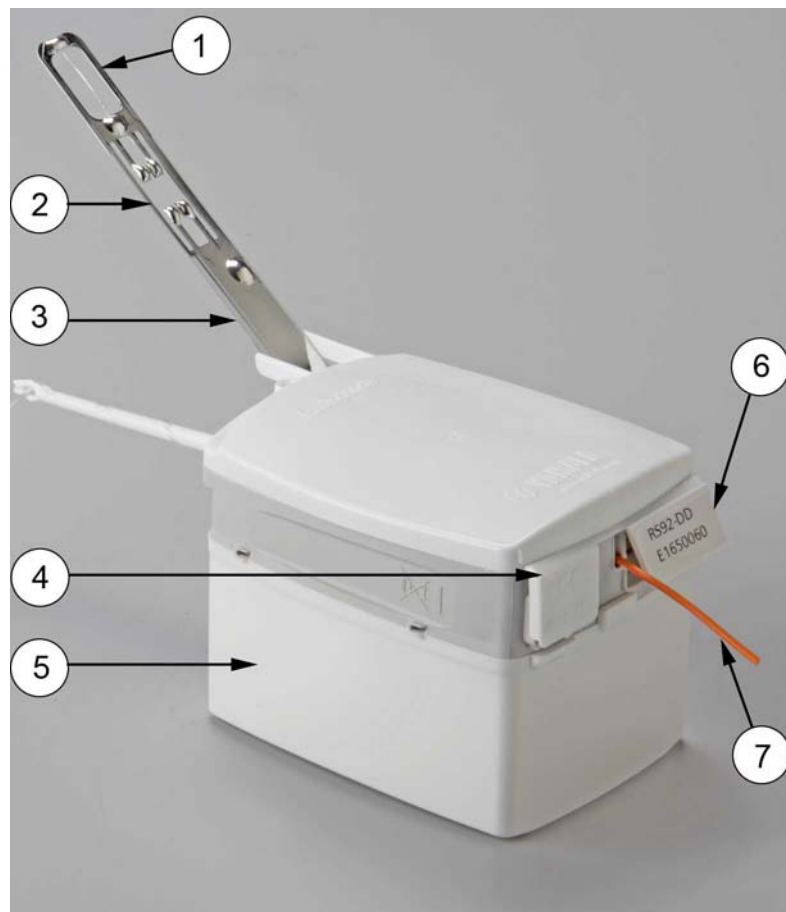
Figure 1   Vaisala Radiosonde RS92-D

1   =   Temperature sensor

2   =   Humidity sensors

3   =   Sensor boom

4   =   Additional sensor interface connector

5   =   Battery case

6   =   GC25/Radiosonde cable interface

7   =   Antenna

CHAPTER 3
OPERATION

This chapter contains information that is needed to operate this product.

General

It is essential that you carry out the pre-launch steps as instructed and always in the same way. Follow the instructions in the sections below and refer to Appendix A on page 39 for proper and safe balloon preparation.

The workorder for a sounding is as follows:

1. Prepare the balloon and optional sounding accessories.
2. Unpack the radiosonde.
3. Prepare the sounding.
4. Connect the battery.
5. Launch the radiosonde.
6. Monitor the sounding with the sounding system.

Preparing the Balloon and Optional Sounding Accessories

The balloon and the optional sounding accessories must be prepared before connecting the radiosonde battery and thereby activating the radiosonde. This is necessary because the radiosonde should be launched within 15 minutes of battery connection.

WARNING	Read the safety instructions in Appendix A before proceeding. Normally the balloon-lifting gas (hydrogen or helium) is supplied in gas bottles, but hydrogen can also be produced with a hydrogen generator. Carefully study the operation and safety instructions for the gas bottle facilities or the hydrogen generator. Take extreme caution when handling the inflated balloon.

Balloon Preparation

WARNING	It is recommended that the balloon be prepared in a balloon filling shed. The balloon filling shed must be well ventilated so that possible gas leaks do not remain inside the shed, even in situations when there is no electricity.

Follow these steps to prepare the balloon:

1. Load weights that are needed to obtain the required lift onto the gas nozzle.
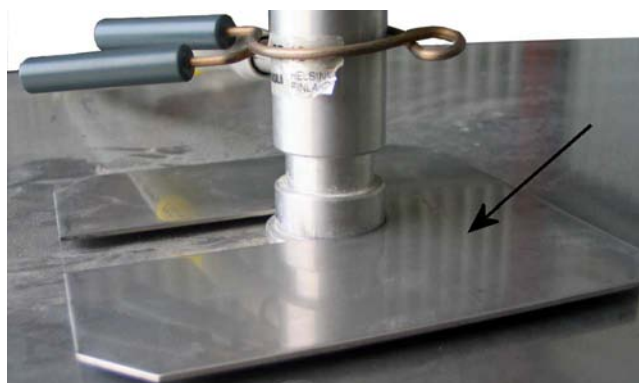
Figure 2   Loading Weights onto the Gas Nozzle

2. Attach the balloon to the gas nozzle by securing the balloon with a piece of string or a clamp.

Figure 3   Attaching the Balloon to the Gas Nozzle

3. Inflate the balloon following the balloon manufacturer's inflation instructions. Do not leave the balloon-filling shed while inflating the balloon.

Figure 4   Inflating the Balloon

4. When the balloon is sufficiently filled, in other words, the balloon just raises the gas nozzle, close the gas valve.
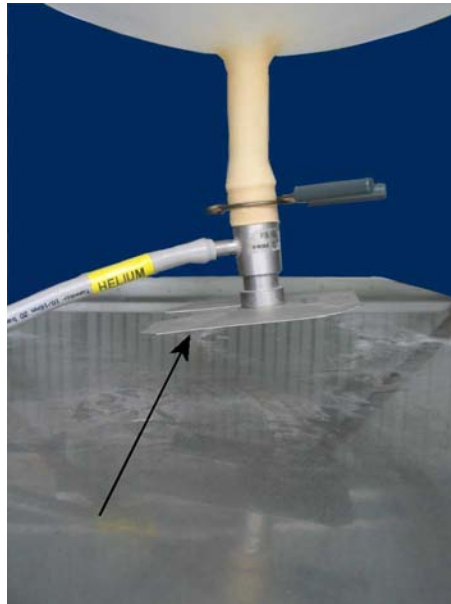
Figure 5   Balloon Raises the Gas Nozzle

5.   Secure the neck of the balloon tightly with a string before removing
     the balloon from the gas nozzle.
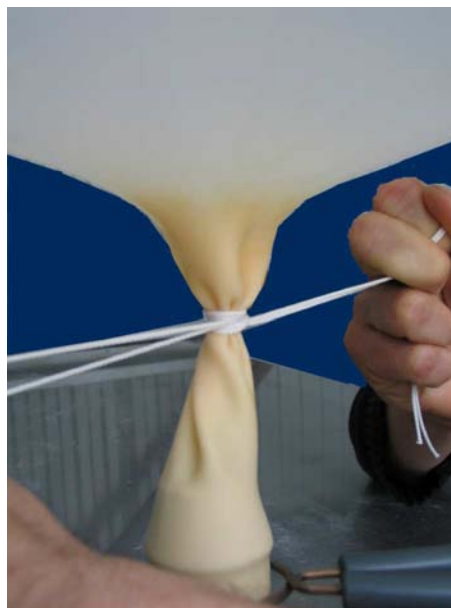
Figure 6   Securing the Neck of the Balloon
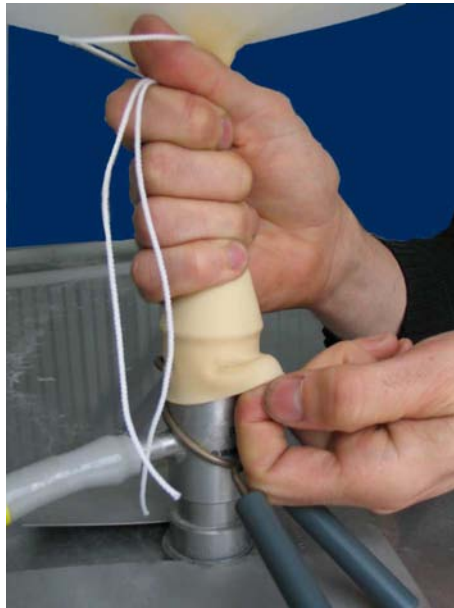
Figure 7   Removing the Balloon from the Gas Nozzle

6.   Fold the neck of the balloon over and secure it firmly. Tie the string high enough to ensure that the unwinder fits easily.

Figure 8   Folding the Neck of the Balloon

7.   Leave the balloon waiting in the balloon-filling shed while you prepare the radiosonde. Make sure the balloon does not touch anything. Hold the balloon by the neck.

NOTE	When using a balloon with an integrated parachute, make sure that a sufficiently long piece of the parachute string is poking out of the balloon neck in order to fasten the string to the radiosonde unwinder.

Optional Sounding Accessories

The RS92 unwinder RSU911 is designed to be attached directly to the folded balloon neck. However, you can use the same unwinder if you use optional sounding accessories, such as a parachute or a radar reflector.

Always attach the unwinder to a relatively firm support, such as the balloon or the parachute spreader. The support must not let the unwinder twist freely, or otherwise the suspension string might unwind at too high a speed and the radiosonde hit the ground during the launch. The unwinder must also be able to swing slightly during the sounding.

Attach all optional sounding accessories next to the balloon, or otherwise they disturb the measuring environment of the radiosonde and no proper temperature and humidity measurements can be made.

CAUTION	The strength of all the strings used during soundings must exceed 25 kp (250 N). Knots in the strings weaken the strength to the minimum of 40 % of the original string strength. This results in a string strength of 10 kp (100 N), which is sufficient for RS92 soundings.

Table 3   **Ordering Codes for Optional Sounding Accessories**

Item	Code	Note
Totex parachute	15046	
Rubber plate	RS46158	Used with a radar reflector
Hanger board	RS46157	Used with a non-Totex parachute

Totex Parachute 5710-5

The recommended parachute is the Totex type 5710-5 (Vaisala code 15046). In the Totex parachute, an elastic ribbon loop hangs the unwinder securely under the spreader.

Attach the parachute directly to the balloon with the parachute string.

See for details. For unwinder attaching instructions, see section .

Radar Reflector

Attach the unwinder to the radar reflector with a rubber plate accessory (Vaisala code RS46158). The rubber plate accessory lets the unwinder swing properly, making sure that the suspension string is unwound smoothly.

1. Tie the radar reflector to the balloon with a string of approximately 50 cm in length.

2. Attach the rubber plate (RS46158) to the radar reflector.

See for details. For unwinder attaching instructions, see section .

Non-Totex Parachute

If you are using a parachute that has no firm objects to prevent the unwinder from twisting, you have to use a hanger board (Vaisala code RS46157).

1. Tie the parachute to the balloon with a string.

2. Tie the hanger board to the parachute with a string of approximately 20 cm in length.

See for details. For unwinder attaching instructions, see section .
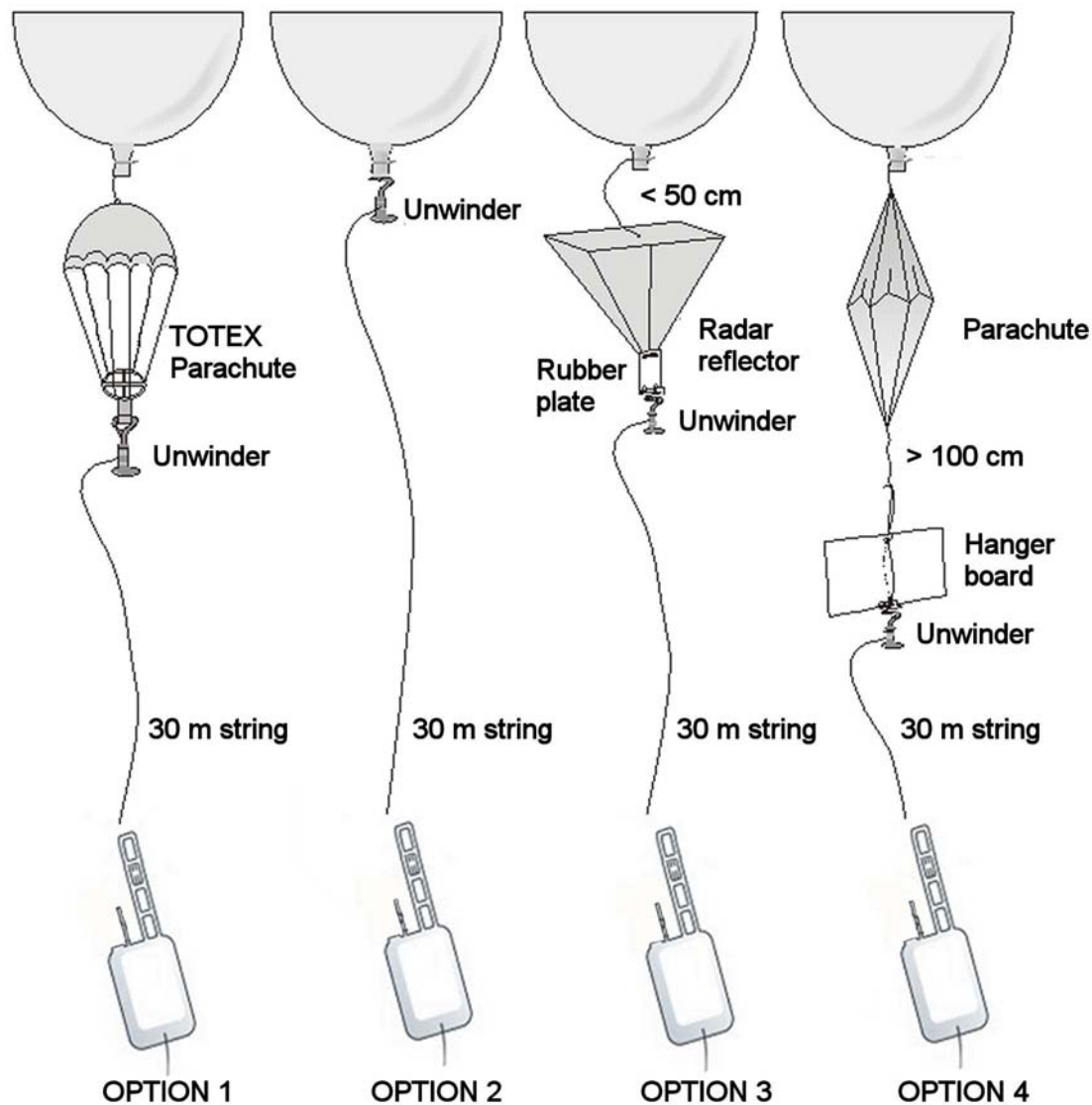
Figure 9   Vaisala Radiosonde Sounding Accessories

Option 1 =   Sounding with a Totex parachute

Option 2 =   Sounding with no sounding accessories

Option 3 =   Sounding with a radar reflector

Option 4 =   Sounding with a non-Totex Parachute

Now you can proceed to unpack the radiosonde.

Unpacking the Radiosonde

Follow these steps to unpack the radiosonde:

CAUTION	Do not touch or hit the sensors on the sensor boom. By carefully handling the radiosonde and the sensor boom, you ensure that the radiosonde functions properly during the sounding.

1. Open the foil bag as indicated on the bag.

Figure 10   Opening the Foil Bag

2. Lift the cardboard flap protecting the sensor boom. Be careful to avoid touching or hitting the sensors on the sensor boom.
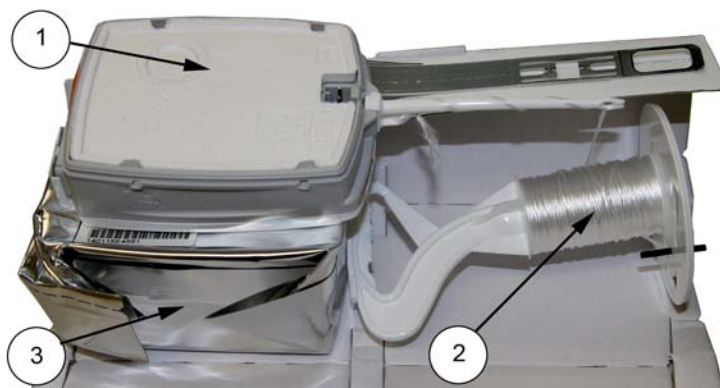
Figure 11   Contents of the Radiosonde Package

1   =   Radiosonde

2   =   Unwinder

3   =   Battery

3. Remove the radiosonde from the package, straighten the antenna, and take the unwinder out of the package.
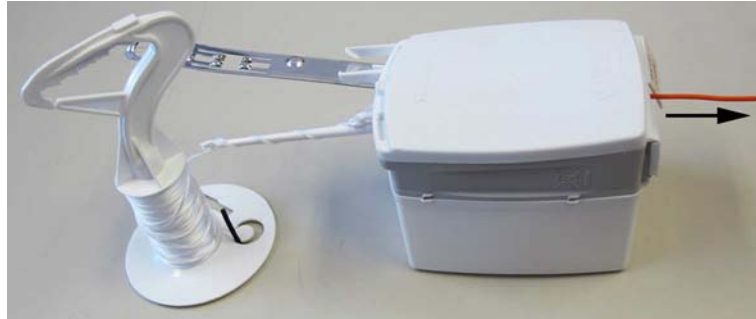
Figure 12   Placing the Antenna Into Flight Position

4. Remove the small plastic rubber wire from the unwinder.

Figure 13   Unwinder Details

1   =   Rubber wire
2   =   Unwinder lip

5. Make sure the plastic lip under which the string runs is level with the unwinder bottom plate. If the lip is bent, bend it gently back to level the position.

Proceed to prepare the sounding.

Preparing the Sounding

NOTE	Radiosonde RS92-D is typically operated with the radiosonde cable or by reading the calibration coefficients via radio. See the relevant sounding system manuals for details. For instructions on using the Ground Check Set GC25, see Ground Check Set GC25 User's Guide.

Follow these steps to prepare the sounding:
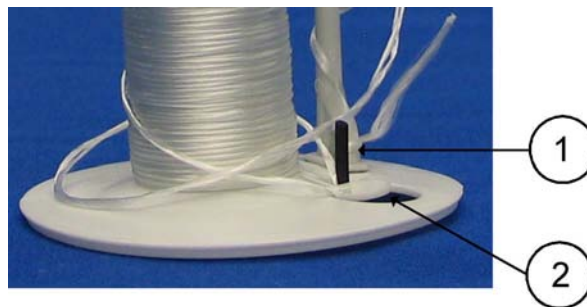
1. Start a new sounding with the sounding system. The sounding system goes through reconditioning, frequency tuning, and timer setting. For detailed instructions, see the relevant sounding system manuals.

2. When prompted, connect the radiosonde cable to the GC25/ radiosonde cable interface in the radiosonde. Text "UP" on the connector faces upwards.

3. When the sounding system is finished, the message "Ready for sonde release!" appears on the display. Disconnect the radiosonde cable.

4. Set the sensor boom into flight position; Back of the radiosonde facing you, press the sensor boom gently forward with your thumbs until the plastic clips on both sides of the sensor boom click (you may have to spread the plastic clips slightly) and the sensor boom sits firmly in the bent position.

CAUTION	Only touch the bottom of the boom. Do not touch or hit the sensors.
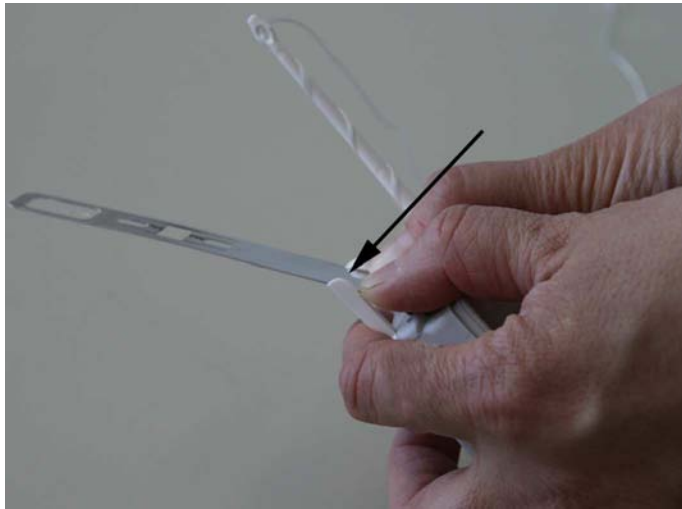
Figure 14   Placing the Sensor Boom into Flight Position

The sensor boom is now in the flight position and remains so throughout the sounding. Now proceed to connect the radiosonde battery.

Connecting the Battery Set

General

The RS92-D battery set ordering codes are given in .

Table 4   RS92-D Battery Sets

Ordering Code	Battery	Description
RS92-DD	RSB511	Dry-cell Battery Set
RS92-DL	RSB611	Lithium Battery Set
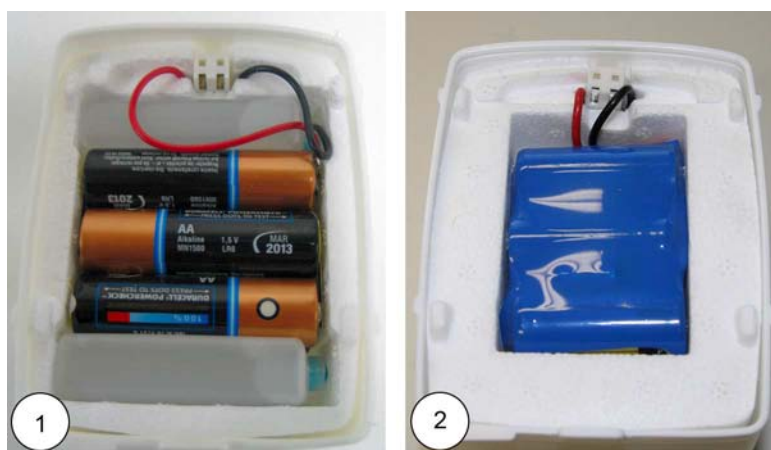
Figure 15   RSB511 Dry-cell Battery Set (Number 1) and RSB611 Lithium Battery (Number 2)

Connecting the Battery

Follow these steps to connect the battery to the radiosonde:

1. Open the foil bag as indicated on the bag.

Figure 16   Battery Package

2. Take out the battery connector (number 1 in) by gently pulling the wires.

Figure 17   Battery Connector Shown with RSB611

3. Connect the battery connector (number 1 in Figure 18 on page 27) to the radiosonde (number 2).
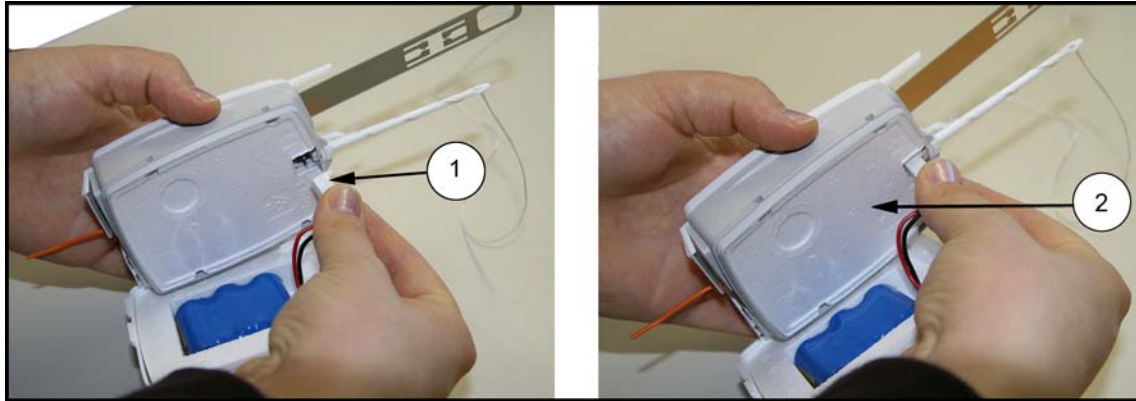
Figure 18   Connecting the Battery Connector to the Radiosonde

4. The radiosonde has now been activated. Close the battery case.

5. Check from the sounding system software that the telemetry link is working well. For detailed instructions on using the sounding software, refer to the sounding system user manuals.

The radiosonde is now prepared for launch. In order to ensure 120 minutes of flight time, it is recommended that the radiosonde is launched within 15 minutes of battery connection.

Proceed now to launch the radiosonde.

Removing the Battery Case

If you need to remove the battery case from the radiosonde, use, for example, a small coin to loosen the battery case. Push the coin into the small opening between the radiosonde and the battery case to loosen the case and remove it. See Figure 19 on page 28.

Figure 19   Removing the Battery Case

Launching the Radiosonde

The radiosonde is now ready for launch.

Attaching the Unwinder

The unwinder is used to unwind the suspension string gently and slowly. To do this, the unwinder must be attached firmly, so that it does not rotate relative to the balloon. If the unwinder moves freely, the suspension string unwinds too quickly, and it is possible that the radiosonde hits the ground upon launch.

The unwinder is designed to be tied directly to the balloon.

If you cannot attach the unwinder directly to the balloon, for example, when using a radar reflector or a parachute, sounding accessories are

needed to restrict the movement of the unwinder. For instructions, refer to section .

Attaching the Unwinder to the Balloon

Follow these steps to attach the unwinder directly to the balloon:

1. Pass the unwinder hook through the loop created by the tied balloon neck.

2. Make sure that the hook comes out the other side, as shown in . The unwinder is now attached firmly to the balloon.

If you are using a balloon with an integrated parachute, fasten the parachute string poking out of the balloon neck to the unwinder.

Figure 20   Attaching the Unwinder to the Balloon

If you use optional sounding accessories, follow these instructions to attach the unwinder.

Totex Parachute

The Totex parachute 5710-5 has an elastic ribbon loop below the spreader. Attach the unwinder to the loop by pushing the hook out the

other side in the same fashion as with the folded balloon neck (see section Attaching the Unwinder to the Balloon on page 29).

Radar Reflector

There is a rubber plate attached to the radar reflector. Attach the unwinder to this plate.

Non-Totex Parachute

There is a hanger board tied to the parachute. Attach the unwinder to the bottom of the hanger board.

Releasing the Balloon

In order to ensure 120 minutes of flight time, the radiosonde should be launched within 15 minutes of battery connection.

Follow these steps to release the balloon:

1. Make sure the suspension string is not tangled.
2. Hold the unwinder to prevent the string from running out before the release.
3. Release the balloon and allow the radiosonde to lift from your hand. Keep the string length between the radiosonde and the unwinder as short as possible.

Checking the Reception

Immediately after the release, check the reception of the radiosonde frequency on the receiver.

Proceed to monitor the sounding with the sounding system.

Monitoring the Sounding

If you have not already done so, enter the surface observation information in the sounding system. Refer to the sounding system's user manual for detailed instructions on using the sounding system software.

CHAPTER 4
STORAGE AND TRANSPORTATION

This chapter provides information for the transport and storage of the product.

Storage

Radiosondes must be stored and used properly in accordance with applicable instructions, the User's Guide, and specifications issued by Vaisala.

Proper storage conditions must fulfill the following requirements:

Radiosondes must be kept in their original packaging (unopened vacuum envelopes) in a dry, ventilated indoor storage space, and within the following key environmental limits (ref. IEC 60721-3-1 class 1K2):

- Temperature +5 °C to +40 °C
- Relative humidity below 85%

CAUTION	The suspension string is not resistant to prolonged exposure to sunlight. Store the radiosondes in their original unopened vacuum envelopes.

Transportation

Vaisala radiosondes must be transported in their original shipping packages. These packages are designed and built to survive and protect their contents in the environmental conditions described herein with the terminology and standards per standard: IEC 60721-3-2. The transportation of radiosondes requires climatic conditions 2K2 and mechanical conditions 2M1 of this standard:

- Transportation in weather-protected conditions.
- Transportation using conventional means (car, truck, and/or aircraft), with free fall not exceeding 0.25 m in any circumstances.
- Following additional markings on packaging.

Do not transport the radiosonde with the battery connected.

Transporting Lithium Batteries and RS92 Radiosondes

RSB611 lithium batteries and RS92 radiosondes with lithium batteries are classified as:

- UN 3090 Lithium metal batteries
- UN 3091 Lithium metal batteries packed with equipment

Consignments must be packed, labeled, and documented according to the IATA packing instructions.

When transporting the radiosondes with lithium batteries, take the following requirements into account:

- The package must display a lithium battery handling label, see Figure 21 on page 33 for an example. The original radiosonde shipping should be used for transport, and it already has the lithium battery handling label.
- The consignment must include a document indicating the lithium content, describing proper handling and procedures for damaged packages, and a telephone number for additional information. The original radiosonde consignment includes a SHIPPER'S DECLARATION FOR ARTICLES NOT REGULATED AS

DANGEROUS GOODS, which should be reused for this purpose after updating the appropriate information.

Figure 21   Lithium Battery Handling Label

NOTE	If the lithium battery is faulty, do not transport it.

CHAPTER 5
FAILURE REPORT AND WARRANTY

This chapter presents information about the failure report and radiosonde warranty.

Failure Report

In case of some malfunction, write a failure report consisting of the following issues:

- What failed (what worked / did not work)?
- Where did it fail (location and environment)?
- When did it fail (date, immediately / after a while / periodically / randomly)?
- How many failed (only one defect / other same or similar defects / several failures in one unit)?
- What was connected to the product and to which connectors?
- What was done when the failure was noticed?

Include the radiosonde serial number in the failure report.

Technical Support

For technical questions, contact the Vaisala technical support:

E-mail   helpdesk@vaisala.com

Fax   +358 9 8949 2790

If the product needs repair, please follow the instructions below to speed up the process and to avoid extra costs to you.

1. Read the warranty information.

2. Contact Vaisala technical support via e-mail or fax and request for RMA (Return Material Authorization) and shipping instructions.

3. Proceed as instructed by Vaisala technical support.

NOTE	RMA must always be requested from Vaisala technical support before returning any faulty material.

Radiosonde Warranty

The following Vaisala Radiosonde general warranty statement is effective as of 02/2007. However, please refer to the applicable supply contract for the specifics of your warranty terms. If there is a discrepancy between the general radiosonde warranty statement and the radiosonde warranty statement in the supply contract, the provisions of the official radiosonde warranty statement in the supply contract prevail.

Vaisala Radiosonde Warranty Statement

Vaisala repairs or, at its discretion, replaces any Vaisala RS92 radiosonde that is proven, with reasonable satisfaction, to have failed within 13 months of shipment by reason of faulty materials or workmanship, under the following conditions and provided that radiosonde is stored and used properly in accordance with applicable instructions and manuals issued by Vaisala.

Storage Conditions

Radiosonde shall be stored indoors in its original unopened vacuum envelope within the following environmental limits:

- temperature +5 °C to +40 °C

- relative humidity below 85 %

Additional storage requirements for Vaisala AUTOSONDE:

- the maximum number of days radiosonde can be loaded in AUTOSONDE is 14

- relative humidity below 50 %

- temperature +15 °C to +35 °C

Transportation and Handling

Radiosondes shall be transported in the original shipping packaging, which is designed and built to survive and protect the contents in the environmental conditions specified in standard IEC 60721-3-2: climatic conditions of class 2K2, and mechanical conditions of class 2M1 of the standard are required. Instructions on the packaging for transportation and handling shall be followed.

Criteria for Radiosonde Failures

Pre-flight failures under warranty:

- Radiosonde fails during the sounding preparation, or ground check correction exceeds one of the following limits:

    P: $\pm$ 3 hPa

    T: $\pm$ 1 °C

    U: $\pm$ 4 %RH (at 0 % RH)

In-flight failures below altitude of 100 hPa under warranty:

- Radiosonde stops transmitting one or more parameters

- Radiosonde transmits clearly erroneous data

- There is a continuous telemetry link failure exceeding 2 minutes

Early termination of sounding caused by balloon burst, user error, or any external cause, is not covered by this warranty.

Making Warranty Claims

A failure report shall be provided for each failed radiosonde stating the radiosonde serial number, a description of the failure, and sounding site and date. A template provided by Vaisala can be used for this.

A radiosonde found defect prior to launch shall be returned to the nearest Vaisala office.

Report of an in-flight failure shall be accompanied by either 1) sounding data file (MW21, MW31 and AUTOSONDE systems) or 2) sounding status report printout (MW11/MW12/MW15 systems) for each failed sounding.

Failure report and any radiosonde failed prior to launch shall be sent to Vaisala within 180 days after the failure, or within a year from extremely remote or shipborne stations.

APPENDIX A
SAFETY INSTRUCTIONS FOR BALLOON OPERATORS

This appendix contains details of safe and proper balloon preparation.

Photocopy these instructions and place the list in clear view in the balloon-filling shed and in the sounding compartment.

1. No smoking or naked flame allowed.

2. If possible, avoid wearing clothing made of nylon or other synthetic fibers to prevent a build-up of static charges. Do not wear shoes with rubber soles.

3. Wear protective glasses.

4. Regularly check that the gas tube fits securely to the gas cylinder or generator nozzle and to the balloon inflation nozzle.

5. Take care to prevent a gas leak in the shed when interrupting inflation to replace a gas cylinder.

6. Never use a repaired balloon.

7. Should a leak develop in the balloon during inflation, do not let gas escape from the balloon inside the shed if possible. Instead, release the defective balloon without load. It is not advisable to deflate the balloon, even outside the shed.

8. Do not touch the balloon with bare hands except when holding it by the neck. Wear soft cotton gloves.

9. Ensure that there are no pointed objects in the shed. Nails, hooks, hinges, padlocks, etc., are dangerous as they might scratch the

inflated balloon. The balloon film is only 0.05 ... 0.1 mm thick
upon launch; the slightest scratch could cause the balloon to burst
prematurely.

10. Keep the doors of the shed shut while inflating the balloon on a
windy day. However, ensure that the shed is properly ventilated.

11. No unauthorized person shall be allowed admittance to the shed
while the hydrogen generator is in operation or balloon inflation is
going on.

12. Ensure that all tools and other implements not essential for balloon
inflation have been removed from the shed.

13. Do not take any electrical devices (cell phone etc.) to the balloon
filling shed or close to the balloon inflated with hydrogen. Safe
distance when outdoors is typically 1.5 meters.

14. Always keep the radiosonde at least 50 cm below the level of the
gas nozzle and the inflated balloon, and at least 1.5 meters away
from the gas cylinder/hydrogen generator, connectors, and tubing.
Avoid taking the radiosonde inside the balloon filling shed, if
possible.

15. Follow all regulations concerning hydrogen safety.

WARNING	New operator! Carefully study the instructions for using the hydrogen generator and for the correct method of inflation.

INDEX

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